

REMARKS

Claims 1-3, 5, 6 and 8-16 are presently pending in the application.

The Examiner has rejected claims 7 and 12-16 under 35 U.S.C. 112, second paragraph, as being indefinite in several respects. With respect to claim 7, Applicants agree that this claim is redundant, and claim 7 has therefore been cancelled. With respect to claim 16, the subject matter of claim 2, defining the openings, has been inserted in claim 16 in order to provide antecedent basis for the arrangement of the openings.

With respect to the central bushing in claim 12, which is also referred to in claims 13 and 14, the bushing is simply the interior lining of the tube-shaped segment (13), as shown in Fig. 1. This lining closely surrounds the electrode (5). Such bushings are well known for passing electrical wires, for example, therethrough. It is not necessary to provide a reference numeral for every element shown in the drawings, but the specification has been amended at paragraph [0014] to conform to the claims. Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

The Examiner has rejected claims 1-16 under 35 U.S.C. 112, first paragraph, as containing subject matter which is not described in the specification in an enabling manner. The Examiner contends that the steel tube 2 is not adequately disclosed, questioning whether the tube is intended to be an electrode or if the steel tube is intended to be a protective shield for the solid electrolyte, that then melts away upon insertion of the probe into a sample. If the latter, the Examiner asks where there is the disclosure of that. This rejection is respectfully but strenuously traversed for the reasons set forth below.

Measuring devices of the generic type disclosed and claimed in the present application are well known in the art, as discussed in paragraphs [0002] thru [0004] in the Background section of the present application. Such devices are shown, for example, in German published patent applications DE 30 21 949 A1 and DE 28 42 136 A1. Metal or steel tubes, like the steel tube 2 of the present invention, are shown as protective shield 8 in DE 30 21 949 A1. As stated at page 7, lines 15-18 of this reference:

“The zirconium oxide tube 3 is closely surrounded with a protective shield 8, which is made of a metal, which melts upon immersion in the molten melt”.

Similarly, a metal tube 8 is shown in DE 28 42 136 A1. At page 7, lines 9-11, this reference states:

“It is to be noted that the part 8 of the metal sleeve is destroyed during the immersion of the device in the melt . . .”

Also enclosed for the Examiner's information is a copy of U.S. patent 4,342,633, which is the U.S. counterpart of DE 28 42 136 A1. This patent shows a metal shield 30 which corresponds to the metal shield 8 of the two German references and the steel tube 2 of the present invention. The Examiner's attention is respectfully directed to column 2, lines 17-41, which describes the manner in which the shield 30 is consumed after the initial immersion in the molten metal bath.

In view of these references, and the fact that they are clearly referred to in the background section of the present application, it is submitted that the disclosure regarding the steel tube 2 is indeed adequate and would be readily understood by a person skilled in the art. Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

The Examiner has rejected all of the claims under 35 U.S.C. 103(a) as being unpatentable over DE 30 21 949 A1 in view of various combinations of other prior art references. According to the above amendment, the subject matter of claim 4 has been incorporated into claim 1. Since all of the remaining claims now depend from original claim 4 (now claim 1), it is only necessary to discuss the Examiner's rejection of claim 4, and the remaining rejections are moot. Therefore, while not necessarily agreeing with the other rejections or the Examiner's arguments in support thereof, none of the other rejections will be discussed.

The Examiner has rejected claims 4 and 12-15 under 35 U.S.C. 103(a) as being unpatentable over DE'949 in view of French patent publication 2122758 (French'758), U.S. Patent 3,752,753 of Fitterer et al. or U.S. Patent 4,105,507 of VonKrusenstierna et al. (VK). The Examiner notes (bottom of page 3 and top of page 4 of the Office Action) that DE'949 discloses a probe supported at one end of a carrier tube for use in a melt, wherein the probe comprises a solid electrolyte tube surrounded by a metal tube and containing a reference material and a filler. An electrode conductor rod extends from the reference material outwardly of the tube through a cap that encloses its upper end. While DE'949 does not disclose a gas permeable cap, the

Examiner contends that each of French'758, Fitterer and VK discloses a cap or stopper which is porous or has an opening for venting or equalizing pressure.

With respect to claim 4, the Examiner acknowledges (bottom of page 5 of the Office Action) that this claim differs from the combination of DE'949, French'758, Fitterer or VK in not disclosing a cap made of plastic. However, the Examiner contends that Kato discloses a probe with an enclosure cap having a planar shoulder portion and a conical portion made of plastic. The Examiner concludes that it would have been obvious to adopt the cap of Kato for the probe of DE'949, since such a cap would provide more sealing surface and thus a better seal for the electrode rod. This rejection is respectfully but strenuously traversed for the reasons set forth in detail below.

Applicants concede that DE'949 discloses a probe of the generic type to which the present invention is directed, as already acknowledged in the Background section at page 1 of the specification. Applicants also concede that French'758, Fitterer and VK disclose probes for use in melts wherein the cap or stopper has an opening which vents or allows equalization of pressure built up in the tube during heating. However, as acknowledged by the Examiner, none of DE'949, French'758, Fitterer or VK discloses a plastic cap for closing a solid electrolyte tube in a probe used in molten metals. Moreover, Applicants are not aware of any use in the prior art of a plastic cap with solid electrolyte sensors used in molten metals. It is submitted that such use, as presently claimed, is novel and unobvious, as well as being quite unexpected.

The Examiner's citation of Kato as disclosing an enclosure cap made of plastic is irrelevant to the presently claimed invention and the other four prior art references with which the Examiner attempts to combine Kato. First, Kato is not directed to a probe used in molten metals, but rather to a reference electrode system used at room temperature for pH measurements, titrations, specific ion measurements, or the like (column 1, lines 11-14). There is no indication that it would be operable in a molten metal, and the outer body 44, made of glass or polymer, would be destroyed upon immersion in the metal melt. Second, Kato does not disclose a porous or gas-permeable cap, as presently claimed, and there would be no reason to make the cap of Kato porous, since the electrode is used at room temperature, so that there is no pressure buildup inside the electrode during operation. Moreover, making the cap of Kato

porous would defeat one of the important objectives of Kato, namely preventing contamination of the electrolyte in the reference electrode.

Further, it is submitted that it is totally unexpected and therefore non-obvious, to use a plastic cap for a measuring device in molten metals (high temperature applications), because a person skilled in the art would expect that the plastic cap will melt during use of the device. Surprisingly, the plastic closure of the presently claimed invention does not melt during use and, in fact, remains gas-permeable. This is further surprising because one skilled in the art would expect that the openings or pores would close up at high temperatures.

For all of the above reasons, it is submitted that the rejection of claim 4 (now claim 1) and all of the claims depending therefrom is improper and should be withdrawn. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

Finally, it is noted that with respect to the rejection of claims 5 and 6, directed to particular types of plastic material for the closure, the Examiner has additionally relied upon U.S. Patent 3,755,125 of Shaw et al. and U.S. Patent 3,959,107 of Horner et al. The Examiner contends that it would have been obvious to make the closure of DE'949 of polypropylene in view of either Shaw or Horner, since polypropylene is an inert, inexpensive and readily available material that can be easily applied as a shrink tube to effect a good seal.

These rejections are also respectfully but strenuously traversed, because Shaw and Horner, like Kato, are directed to measuring electrodes or electrolytic cells which are used at room temperature or at least not in high temperature environments. Applicants can find no indication in either of these references that these devices would be usable in molten metals. Accordingly, the rejections based upon these references are also improper and should be withdrawn.

In view of the above amendments and remarks, it is submitted that all of the claims in the application fully comply with the requirements of 35 U.S.C. 112 and patentably distinguish over the prior art of record. Accordingly, a reconsideration and withdrawal of the rejections and an early Notice of Allowance are respectfully requested.

Respectfully submitted,

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Enclosures: Copy of U.S. Patent 4,342,633